November 2016

USDA-ARS
Dale Bumpers National Rice Research Center Highlights
Stuttgart, Arkansas

For More Information: Dr. Anna McClung, Research Leader/Center Director
anna.mcclung@ars.usda.gov

1. Recently Accepted Publications

Marcos André NOHATTO, Dirceu AGOSTINETTO, David Robert GEALY, Luis Antonio de AVILA, Bruno Moncks da SILVA, Nixon da Rosa WESTENDORFF. 2016. Relative competitive ability of rice with strawhull and blackhull red rice biotypes. Científica, Jaboticabal, v.44, n.2, p.176-184, 2016 [doi.org/10.15361/1984-5529.2016v44n2p176-184]

Weedy red rice is the same species as commercially produced rice and is a major weed pest in regions of the southern U.S. and southern Brazil, but its competitive activity against new commercial varieties has not been thoroughly investigated. In a collaborative greenhouse study with scientists in Brazil and in Arkansas, we evaluated the competitive ability of a tall, long-grain U.S. rice variety (CL-142AR) against two common but genetically diverse weedy red rice biotypes (strawhull and blackhull biotypes) from the southern U.S. By planting the rice and weedy red rice plants in mixtures at different seeding ratios, we were able to show that both the strawhull and blackhull red rice biotypes grew aggressively, easily out-competing the commercial rice variety, and that the blackhull biotype was more competitive of the two red rice biotypes. These findings demonstrated how commercial rice varieties can be highly susceptible to competition from the diverse red rice biotypes in U.S. rice fields. Because the commercial variety demonstrated little ability to compete with the weedy red rice biotypes this demonstrates that, if left unchecked, weedy red rice may remain a major weed pest in rice fields. Our results support earlier reports from farmers that weedy red rice is among the most competitive and devastating weeds afflicting their rice fields, and emphasizes the need for its aggressive management in rice and rotational crops.

Ghazi IA, Zarei I, Mapesa JO, Wilburn JR, Leach JE, Rao, S, Broeckling CD, McClung, A, and EP Ryan. 2016. Rice Bran Extracts Inhibit Invasion and Intracellular Replication of *Salmonella typhimurium* in Mouse and Porcine Intestinal Epithelial Cells. Med Aromat Plants (Los Angel) 5: 271. doi: 10.4172/2167- 0412.1000271

Salmonella infections cause human illnesses that result in more than 200,000 deaths globally each year. Adding rice bran to diets has been shown to inhibit *Salmonella* infection in animals. The aim of this study was to determine if bran extracts from two distinct rice varieties, Lijiangxintuanheigu (LTH, having red bran) and Sanhuangzhan-2 (SHZ-2, having brown bran), differed in their ability to inhibit *Salmonella* cell invasion and proliferation. Rice bran extracts were tested *in vitro* using mouse small intestine epithelial cells and intestinal porcine epithelial cells. The tissue cells were grown on media containing different amounts of rice bran extracts from the two rice varieties. Bran from the LTH variety resulted in reduced entry and intracellular replication of *Salmonella* in both the mouse and porcine tissue cells when compared with SHZ-2. Analysis showed that most of the differences in LTH and SHZ-2 bran composition were due to secondary metabolites, lipids, and dipeptides. These findings demonstrate the potential of rice bran as a dietary alternative for prevention of *Salmonella* infection and that varieties differ in metabolic compounds that may be related to this health beneficial effect.

Xing, J., Jin, Y., Peng, Z., Shi, Y., He, Q., Shu, F., Zhang, W., Zhang, Z., and Deng, H. 2016. Characterization of molecular identity and pathogenicity of rice blast fungus in Hunan province of China. Plant Disease. http://dx.doi.org/10.1094/PDIS-03-16-0288-RE

Disease resistance in rice depends on genes that recognize pathogen infection and can mount a timely defense response. Rice blast disease caused by *Magnaporthe oryzae* is the most damaging rice disease worldwide. Major plant resistance (*R*) genes (*Pi* genes) recognize pathogen strains according to their corresponding avirulence (*AVR*) genes resulting in a resistance response by the plant. Unfortunately, pathogens can overcome disease resistance genes by evolving infection signals that escape plant detection. Many hybrid rice varieties in Hunan province in China have lost resistance to *M. oryzae*. To identify new blast *R* genes that can be used to breed disease resistant varieties, genomic technologies were used to analyze 182 field blast isolates from several ecological districts of rice production areas in Hunan province and rice varieties that possess known combinations of 24 major *R* genes. A total of 28 races out of 182 were identified and were grouped into 20 different categories. The results suggest that *Pi9*, *Piz5*, *Pikh*, and *Pikm* are the most effective blast *R* genes for use in breeding for rice production areas in Hunan province. This research demonstrates how genomic information of the crop plant and plant pathogens can be used to guide deployment of the most effective sources of plant disease resistance.

2. Technology Transfer

a. Formal Events:

To Non-research Stakeholders

On November 4, 2016 Drs. Anna McClung and Ming Chen visited with a delegation from Taiwan accompanied by Mr. Bob Cummings with the USA Rice Federation to discuss rice grain quality of US cultivars. The delegation included representatives from Taiwan Agriculture and Food Council involved in importing rice and Taiwan Rice Millers Association interested in importing US high amylose rice cultivars that have special processing properties to make rice products. Dr. Chen arranged for several high amylose cultivars to be shipped to Taiwan from multiple state breeding programs to evaluate the potential of US rice varieties for processing properties as desired in Taiwan.

To Research Community

On November 6-9, Drs. Shannon Pinson and Georgia Eizenga attended the Tri-society [Crop Science Society of America-American Society of Agronomy-Soil Science Society of America] annual meeting in Phoenix, Arizona. Dr. Pinson gave a presentation entitled "Metabolic Differences Found in Seedlings of Rice Varieties That Produce Grains Low Versus High in Arsenic Concentration". Dr. Eizenga spoke on "Exploring the Power of Rice (*O. sativa* x *O. rufipogon*) Chromosome Segment Substitution Line Libraries".

On Nov 14 -15, 2016 Drs. Yulin Jia and Anna McClung participated in the annual project meeting for the USDA/NIFA/AFRI grant entitled "Novel Strategies for Managing Blast Diseases on Rice and Wheat" at the USDA ARS Foreign Disease-Weed Science Research Unit, Fort Detrick, MD. Dr. Jia gave updates on the research team's progress on enhancing resistance to rice blast disease. Dr. McClung served as a member of the project's review board. This multi- institutional integrated blast project has progressed for 4 years and will be completed at the end of next year.

b. Informal Contacts

On November 15, 2016 Drs. Jeremy Edwards and Georgia Eizenga hosted Dr. Matthew Blair from Tennessee State University, Ph.D. student Xingbo Wu, and Beachell-Borlaug International Scholar Naransa Limpot. The group was interested in learning about rice, DNA marker technology, bioinformatics and rice grain quality. During their visit they were given an overview of the center's research and visited with Drs. Ming Chen and Shannon Pinson, as well as staff in the Genomics Core Facility.

c. **New MTAs**

d. **Germplasm Exchanged:**

During November, 621 rice accessions from the Genetics Stocks *Oryza* (GSOR) collection were distributed to researchers in the US and Belgium.

3. Education and Outreach

An article about an outreach event by Dr. Shannon Pinson, entitled "Classroom experiment reveals third graders perceptions of science, scientists", was published in Crop Science Association News (doi:10.2134/csa2016-61-11-15), the monthly magazine sent to the members of the Agronomy Society of America, the Crop Science Society of America, and the Soil Science Society of America (approx. 5000 members in all). Included in the educational event Dr. Pinson asked the students to draw a picture of what they thought a scientist looked like.

On Nov. 11, Anna McClung, Yulin Jia, Melissa Jia and Jeremy Edwards worked with Gena Seidenschwarz, Archivist with the Museum of the Arkansas Grand Prairie in Stuttgart, AR, to collect native grass species from the Roth Tall Grass Prairie that is managed by the Arkansas Natural Heritage Commission. The purpose of the collection was for a garden in front of the Museum that demonstrates the plant diversity that is responsible for the rich agricultural soils found in Arkansas.

4. New Significant Research Collaborations

International
USA